Wash. state scientists using drones to spy on nature

July 19 2013, by Sandi Doughton, The Seattle Times

LA PUSH, Clallam County, Wash. - model airplane. As the propeller started to whirl, Morgan cocked his arm and flung the plane as if he were throwing a spear.

The 4-foot-long aircraft banked gracefully and spiraled up into a cloud-streaked sky. Within seconds, it blended in among the targets it was dispatched to spy on: cormorants, gulls and murres wheeling above the tiny islands on the Washington coast where the birds nest and rear their young.

The miniature plane is a drone, a Puma AE, part of a $350,000 unmanned aircraft system. Once used mostly for surveillance and reconnaissance on the battlefield, small, unmanned aircraft like the Puma are quickly catching on in the civilian world - with scientists like those aboard the Research Vessel Tatoosh last month leading the way.

The team of federal biologists spent two weeks flying fixed-wing Pumas and mini-helicopters over remote beaches to test their usefulness for seabird and marine-debris surveys.

"They're wonderful tools," said Matt Pickett, who helped coordinate the project for the National Oceanic and Atmospheric Administration. "They have the potential to change the way scientists do marine monitoring."

Already home to a thriving drone industry led by Boeing subsidiary

Insitu, the Pacific Northwest is also a hot spot for putting the devices to work in the service of science. Researchers in Washington are using them to monitor restoration of the recently un-dammed Elwha River. Scientists from Oregon State University are flying drones over potato fields this month to see if thermal sensors can identify ailing plants early enough to save them.

Drone-mounted cameras have also helped biologists identify habitat for endangered pygmy rabbits, while fish managers use mini-choppers to map chinook salmon spawning sites on the Snake River. Projects on the drawing board include the use of drones for avalanche and snowpack surveys and glacier monitoring.

Though some residents on the Olympic Peninsula were unhappy to have their turf invaded by tiny aircraft, the scientific use of drones hasn't yet drawn the same type of privacy concerns that forced the Seattle Police Department to warehouse its unmanned aircraft. Several states, including Idaho and Montana, enacted restrictions this year on the use of drones for law enforcement or to spy on people.

"For things like surveying eagle nests and trumpeter swans and vegetative analysis, I would say 99 out of 100 people have supported what we're doing," said Mike Hutt, who manages 36 drones - one of the largest civilian fleets - for the U.S. Geological Survey and the Department of the Interior.

The USGS first experimented with drones during Mount St. Helens' 2004 eruption. The small airplanes didn't fare well in turbulent weather and the sensors weren't as good as those on manned helicopters, said USGS volcanologist John Pallister, of the Cascades Volcano Observatory in Vancouver, Wash.

But the experiments proved it was possible to collect data from an

erupting volcano with drones - something scientists did earlier this year in Costa Rica.

Since 2004, cameras, heat sensors and other instruments have shrunk dramatically while navigation and control systems have improved. Coupled with the development of smaller, more affordable vehicles, those advances are helping fuel a science rush, Hutt said.

Unmanned-aircraft manufacturers are also courting new customers as the U.S. pulls back from Iraq and Afghanistan. "Everybody is happy to sell you stuff," said Juris Vagners, emeritus professor of aeronautics at the University of Washington.

Scientists and public agencies need to steer clear of the hype, consider public reaction and do the math to figure out whether unmanned aircraft are cheaper or better than traditional methods, he cautioned.

The Seattle Police Department's failed attempt to integrate drones into its toolbox cost taxpayers $82,000.

NOAA's operations on the Washington coast this summer are part of a two-year project to evaluate the costs and benefits of unmanned aircraft. "We think it's going to save us money and have much less impact on the environment," said coordinator Todd Jacobs.

The craft seem particularly promising for hard-to-reach places and jobs that are tedious or dangerous, and can be operated for about a tenth the cost of a manned helicopter, he said.

Federal biologists survey seabirds on the Washington coast every year, mostly by helicopter, said Sue Thomas, of the U.S. Fish and Wildlife Service. But several survey crews have died in accidents across the country.

In the cabin of the research boat just after the Puma took wing, Thomas watched video from the camera mounted on the little plane's belly.

"These are all common murres," she said, pointing to tight-packed clusters of birds nesting on top of a small island. The noise of a chopper can spook wildlife, Thomas added, but the seabirds seemed oblivious to the silent observer circling overhead.

The biggest obstacles to wider scientific use of drones are the cost and cumbersome regulations, Vagners said.

The price of off-the-shelf aircraft ranges from $10,000 to $350,000 or more, but is dropping rapidly. The Army spent $250,000 each for the fixed-wing AeroVironment Ravens it donated to the Department of the Interior. Similar planes now cost about $20,000, Hutt estimated.

That's still a lot of money for many scientists. "Working with drones isn't nearly as cheap or easy as I thought it would be," said University of Washington environmental engineer Jessica Lundquist, who plans to experiment with small aircraft for avalanche control and snowpack monitoring in the Cascade Mountains.

Most of the craft require two trained operators. And getting approval to fly from the Federal Aviation Administration can take six months to a year. "It has been such a niche industry," Lundquist said. "I think there's a ton of potential, but it's not as far along as you would think."

Though the University of Washington is a hub for development of computer programs, gyroscopes and control systems for drones, most researchers there test their craft indoors only, because of the FAA restrictions.

Much of the burden will be lifted by 2015, when the FAA adopts

national regulations for small drones. In the meantime, many researchers limit their outdoor operations to restricted military airspace, where it's easier to get permission.

William Mell, of the Forest Service's Pacific Wildland Fire Sciences Laboratory in Seattle, travels to a military reservation in Texas to experiment with fire-monitoring drones. His goal is to fine-tune the computer models firefighters use to predict the way blazes will spread.

Mell uses gas-powered aircraft that can stay aloft for several hours. The battery-powered Pumas NOAA tested on the Washington coast have a range of about 8 miles, and can fly for two hours at a stretch. Weighing in at 13 pounds, the Pumas can be disassembled and carried in a backpack.

The portability and stealth that appeals to wildlife biologists is part of what some people fear about drones. When Port Angeles resident Pearl Raines Hewett found out about the seabird surveys, she fired off an angry letter to her congressional representative. After so many instances of government snooping, like the National Security Agency combing through phone and Internet records, Hewett said she doesn't trust scientists who say the images and data they collect will be used only for research.

Indeed, NOAA has experimented with the use of its drones for law enforcement, searching for illegal fishing operations off the coasts of Florida and California, Jacobs said. When the Puma flying near La Push filmed two people walking on the beach, he explained that all human images are erased from the video.

"It disturbs me that this is what my grandchildren and great-grandchildren are going to be living with," Hewett said. "A Big Brother society that is watching you everywhere."

Today's small drones aren't the perfect spying machines many people envision, said Kristi Morgansen, a UW engineer working to make the aircraft more agile and maneuverable. Most cameras used for scientific research have a narrow field of view, and the unmanned systems don't do a good job of searching wide swaths of terrain for small targets.

Improvements are inevitable, though.

"People are very understandably protective of their privacy," Morgansen said. "But somebody is going to develop this technology, and if the U.S. doesn't keep up, that's going to be a real problem."

The use of drones for science represents a return to the field's roots. Many of the early craft were designed to take weather readings and collect atmospheric data. Vagners was part of a team that in 1998 orchestrated the first trans-Atlantic crossing by an aerial drone.

But the military quickly recognized the potential, and has dominated research and development for more than a decade.

Now, the industry is seeking to shed its fearsome image and head off PR disasters over privacy. The Association for Unmanned Vehicle Systems International, the largest industry group, is so eager to promote scientific applications that it sent two staffers to the Washington coast, partly to drum up media coverage of NOAA's work.

There's a lot of money at stake. The Teal Group, an aerospace research firm, estimates that global spending on drones will total $89 billion over the next decade. AUVSI calculates that Washington state could gain 10,000 drone-related jobs by 2025, and the state is competing to be one of six drone testing and research centers designated by the FAA.

Most researchers working with drones are convinced they will soon be

just another research tool. Jacobs and his crew are already laying plans to return to Washington next summer.

As in all field work, drones operate subject to weather. The group lost several days to rain and high winds, but the flying robots themselves are surprisingly robust, Jacobs said onboard the Tatoosh, as the Puma circled in for a landing and splashed down on its belly just off the stern, wings detaching as they are designed to do.

Morgan grabbed the plane and hauled it back into the boat, ready for another run.

But on this summer day, it was old-fashioned technology that brought the expedition to an early halt. Dark smoke in the Tatoosh's exhaust signaled bad news: an engine malfunction that would take more than a week to fix.

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